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(71) Applicant(s)

Thomson Consumer Electronics Inc

(Incorporated in USA - Delaware)

10330 North Meridian Street, Indianapolis,  
Indiana 46290-1024, United States of America

(72) Inventor(s)

Roy Patrick Lyman

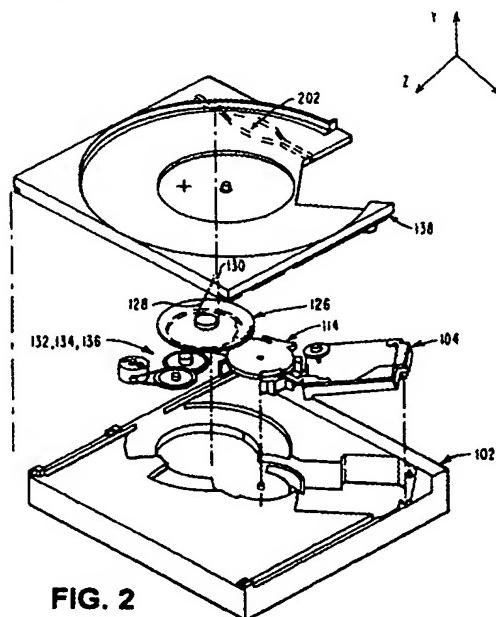
(74) Agent and/or Address for Service

Williams, Powell & Associates

34 Tavistock Street, LONDON, WC2E 7PB,  
United Kingdom

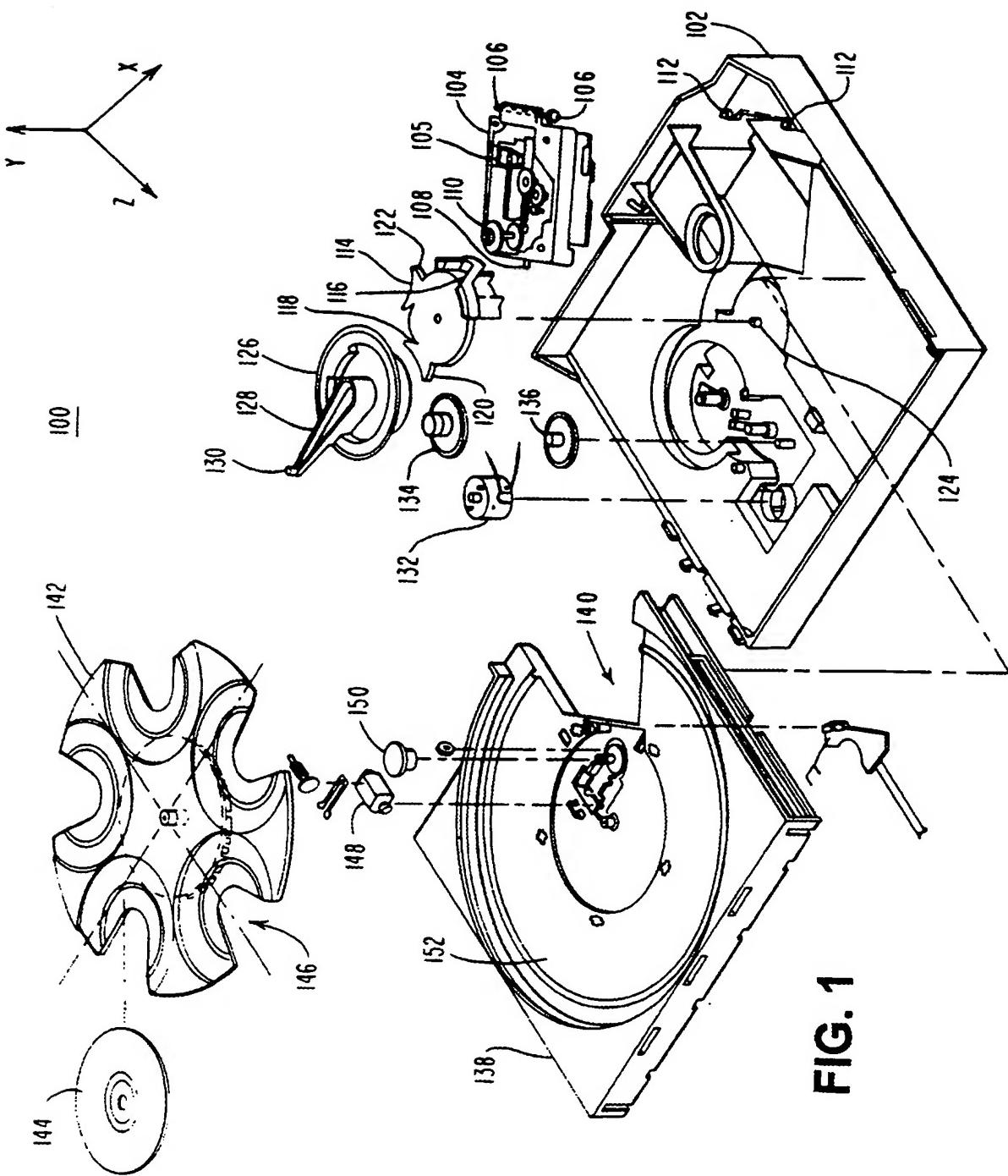
## (54) Disk loading apparatus uses pin arm and guide slot in drawer

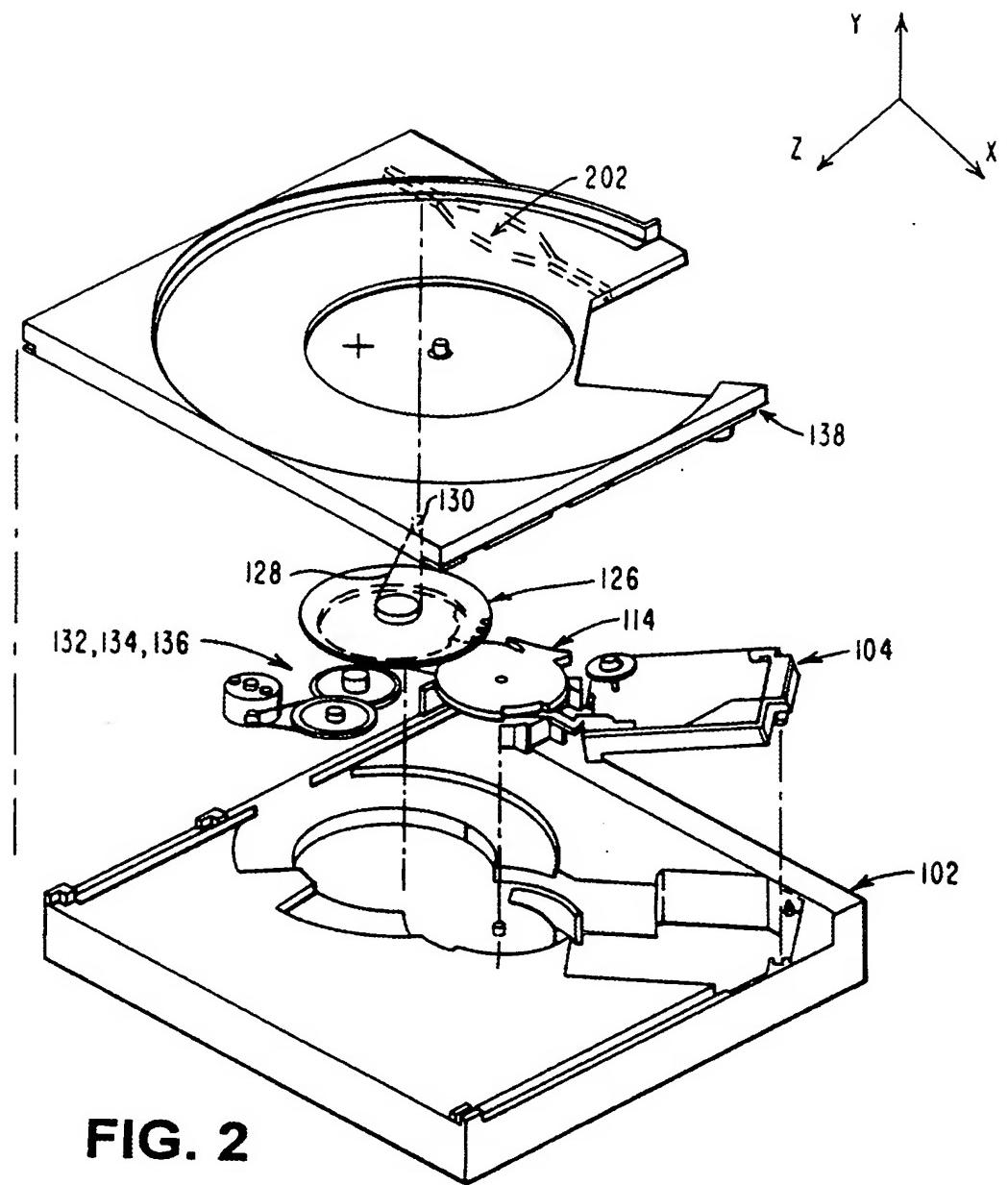
(57) Multiple compact disk carousel mechanism for a CD player has a loading mechanism employing the combination of a motorised rotational pin arm 128 having a pin 130, and a guide slot 202 in the underside of loading drawer 130. Rotation of the arm 128 causes the pin 130 to interact with the boundary walls of the guide slot 202 enabling drawer opening, closing, and locking in the open and closed positions. The rotational arm 128 is coupled to a rotatable locking index 114, rotation of which causes raising and lowering of pickup bracket 104 so that a disk from a platter (142, fig. 1) may be raised and lowered to and from a playing position. The improved design obviates the need for prior art rack and pinion gears for drawer movement, and also obviates the need for separate prior art drawer lock-in and drawer lock-out mechanisms (requiring additional springs, levers and gears).



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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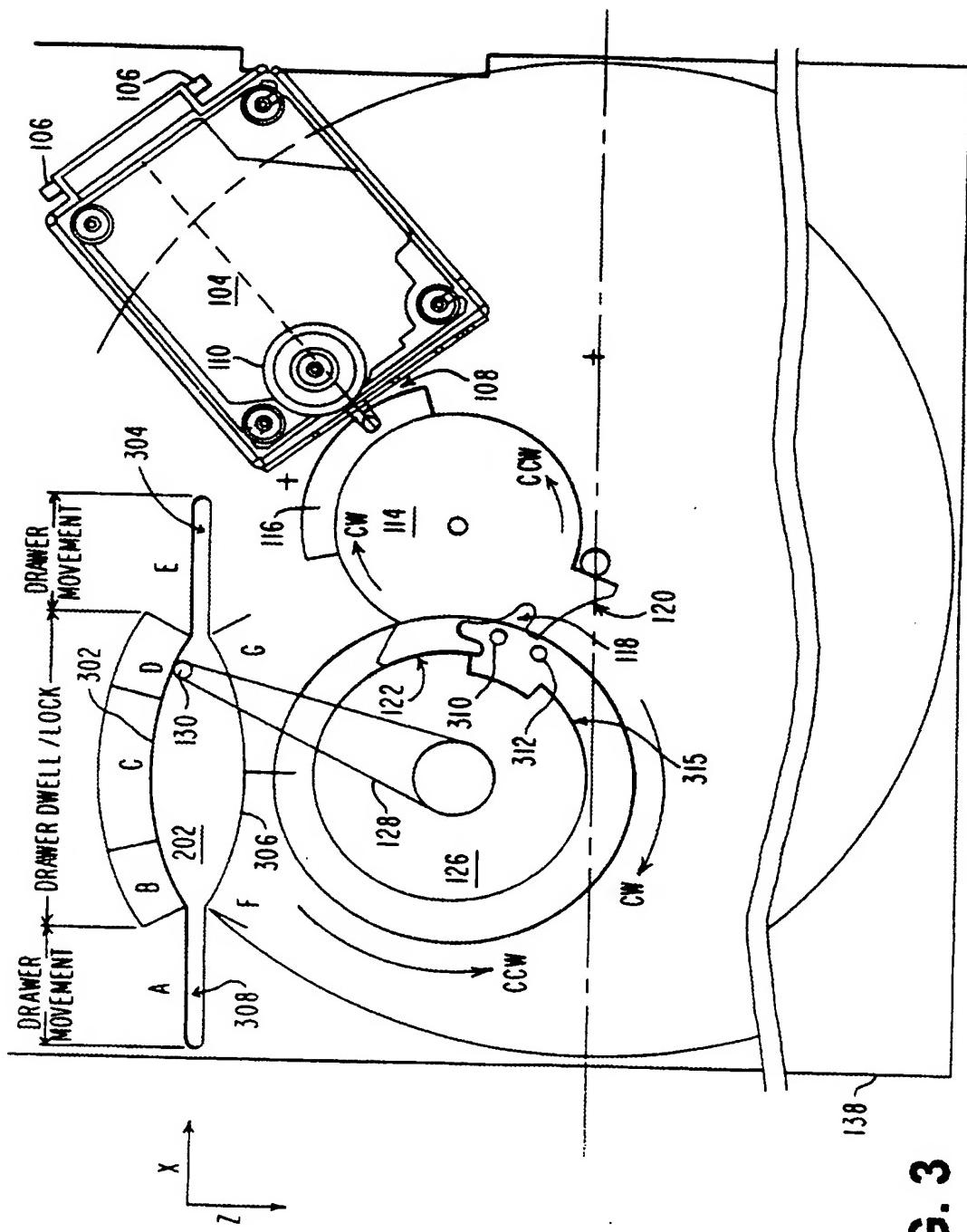


FIG. 3

**2307588**

<sup>1</sup>

**INFORMATIONAL DISC HANDLING APPARATUS  
FOR A MULTIPLE DISC PLAYER**

5      The present invention generally relates to compact disk players. More particularly, the present invention relates to carousel mechanisms which allow a user to load and unload several compact disks to be played by a compact disk player.

Compact disks (CDs) are well known data storage devices 10 which often contain digitally encoded audio and/or video information signals retrievable by special readers, generically referred to as CD players. Many CD players available in recent years--especially those of the audio variety--contain carousel mechanisms for allowing a user to load and unload several disks 15 while a disk is being played.

These carousels generally contain a loading drawer which carries a rotating platter. Several CDs (5 in some models, for example) can be loaded around the circumference of the platter. A pickup bracket raises to lift a selected CD from the platter to a 20 "playing" position. The loading drawer can be opened on user command to allow the user to load or change CDs which will be played after the current CD finishes playing (or is interrupted).

Prior art loading drawer mechanisms use a rack and pinion gear arrangement to move the drawer to the open position. A 25 first locking mechanism keeps the drawer in the open position until the user loads the desirable disks and enters a "close" command. When the drawer is fully retracted (closed) a second locking mechanism keeps the drawer closed until another loading operation is selected by the user.

30      The rack and pinion drawer movement arrangements and the additional locking mechanisms associated with prior art CD carousels often add undesirable manufacturing costs and production times, as well as increase the likelihood of mechanical malfunction.

35      To address the foregoing problems and others, the present invention provides a disk loading and unloading apparatus for

loading and unloading informational disks into a multiple disk player, the apparatus at least including:

a loading drawer adapted to be opened for loading disks by a user, and adapted to be closed in preparation for the disk player  
5 to play loaded disks;

a motorized rotational arm member; and

a pin member coupled to the rotational arm member;

the loading drawer having a pin member guide slot adapted to slidably receive the pin member, the pin member guide slot  
10 having a contour defining an interplay between the pin member and boundaries of the guide slot causing the loading drawer to be opened and closed when the rotational arm member is rotated.

The present invention also solves the foregoing problems by further including a locking means for locking the loading drawer  
15 in place in at least one predetermined drawer position, wherein the locking means comprises the pin member, the pin member guide slot, and the interplay therebetween.

The details of the present invention will be revealed in the following description with reference to the attached drawing  
20 figures.

The drawing figures are briefly described as follows:

25 Figure 1 is an exploded view of a portion of a CD player employing the loading drawer movement and locking mechanism of the present invention;

Figure 2 is a partially exploded view of the mechanism in Figure 1, with the disk carousel removed, showing the relative  
30 positions of the pin arm, locking index and pickup bracket components, as well as the guide slot on the bottom of the loading drawer; and

Figure 3 is a plan view of the loading drawer and its guide slot, the pin arm, locking index, and pickup bracket.

35 Figure 1 shows a CD player 100 with a multiple disk carousel mechanism. A general description of the CD player 100 including

the disk carousel mechanism of the present invention follows. A base 102 has two indentations 112 for receiving two pivot pegs 106 of a pickup bracket 104. The pickup bracket 104 contains a motorized disk mount 110 for rotating a mounted disk 144, along 5 with a disk reader 105 for reading digitally encoded disk information signals. The pickup bracket 104 also contains a guide peg 108 which interacts with a locking index 114 to raise and lower the distal end of the pickup bracket (while pivoting at the proximal end around the pivot pegs 106) as necessary for 10 mounting and playing a disk.

The locking index 114, which is pivotally mounted on a mount 124, has a pin member guide groove 116 for receiving the pickup bracket guide peg 108, a groove region 118, and surfaces 120 and 122. The locking index 114 is peripherally meshed (via 15 pins and a slot) with a rotational arm assembly 126. The rotational arm assembly 126 contains a rotational pin arm 128 and a pin member 130.

A motor 132 and reduction gears 134 and 136 cooperate to rotate the rotational arm assembly 126, as will be described later.

20 A slidable loading drawer 138 carries (in its recessed region 152) a motorized (via motor 148 and gear 150) platter 142 capable of loading five CDs in the preferred embodiment, although alternate embodiments may hold a different number of disks. The platter 142 contains clearance areas 146 at each possible disk 25 mounting location, as shown in Figure 1. The loading drawer 138 also contains a large notch 140 which provides clearance for the pickup bracket 104 when it raises up to the platter to mount a disk in its playing position when a disk is to be played, or during the opening and closing of the loading drawer 138 along the z-axis 30 shown in all of the drawing figures.

The operation of the present invention will now be more fully described with reference to Figures 2 and 3. As can be seen from Figure 2, the pin member 130 of the rotational pin arm 128 fits within a pin member guide slot 202 molded (or attached) to 35 the underside of the loading drawer 138. In brief, when the motor and gears 132, 134 and 136 cause the rotational arm

assembly 126 to rotate and thus displace the pin member 130, the interaction of the pin member with the boundary walls of the guide slot 202 causes the loading drawer 138 to move along the z-axis for "open," "close," and "lock" operations.

5 A more detailed representation of the present-inventive guide slot 202, and the rotational arm assembly 126 is shown in the plan view of Figure 3. Turning to that Figure, it can be seen that the guide slot 202 and the rotational arm assembly 126 cooperate in the manner of a modified Scotch yoke, such that  
10 rotation of the rotational arm assembly 126 causes the pin member 130 to impinge upon the walls of the guide slot 202 to cause translational motion of the loading drawer 138.

With the pin member 130 impinging upon the guide slot wall 302 in region D the loading drawer 138 is in a closed position.  
15 Further, while the centerline of the rotational pin arm 128 is approximately perpendicular to the curvature of the guide slot (i.e., the pin member 130 is in region D), the action of the pin member 130 on the guide slot wall in section D prevents the opening of the loading drawer 138. Thus, when the pin member  
20 130 is at region D, the loading drawer 138 is both closed and locked.

At the location D the locking index 114 has been previously rotated counterclockwise by the action of a pegs 310 and 312 (located on the rotational arm assembly 126) on the groove region  
25 118 of the locking index. The counterclockwise rotation of the locking index 114 causes the guide groove 116 to act as a screw and lift the guide peg 108 and hence the pickup bracket 104 to the "up" position. During this motion, the pickup bracket can mount and lift a disk from the platter 142 (see Figure 1) to a  
30 position above the platter where it may be played. The locking index is locked in the "up" position (after counterclockwise rotation) by a close fit between the surface 122 on the locking index and the surface 315 on the pin arm assembly 126. In this position, the interference between surfaces 122 and 315 prevents  
35 any further rotation (either counterclockwise or clockwise) of the locking index.

When the disk is playing, the loading drawer 138 may be opened to allow the user to access all disk positions 146 other than the one from which the currently playing disk was taken. To accomplish this operation, the rotational arm assembly 126 is rotated clockwise from region D and the pin member 130 moves into region E (304) of the guide slot 202. Further clockwise rotation of the pin arm assembly 126 causes the pin member 130 to begin to pull the guide slot and hence the loading drawer 138 open until the centerline of the rotational pin arm 128 is approximately aligned with the centerline of region E 304. Further clockwise rotation causes the pin member to push the loading drawer via region E 304 until the drawer is completely open. Further clockwise rotation brings the pin member 130 to the region G along guide slot wall 306. The loading drawer 138 is fully open and in the locked position by virtue of the action of the pin member 130 on the wall 306 in region G. The pickup bracket remains in the "up" position with the disk playing.

While the loading drawer 138 is in the open and locked position (with the pin member 130 located in region G) the user can load disks to or unload disks from the platter 142. The software control of the CD player 100 makes the platter disk position from which the currently playing disk was taken, inaccessible to the user while the loading drawer is open. The remaining four disk positions 146 may be accessed through the open portion of the drawer 138 by toggling the platter 142 with partial clockwise and counterclockwise rotations. The loading drawer 138 is required to be locked in the open position during disk loading/changing operations so that the drawer cannot be inadvertently pushed closed while the empty disk well (from which the playing disk came) is not aligned with the playing disk. Otherwise, a collision of a non-playing disk and the pickup bracket could occur, leading to failure of the unit.

After disk loading and unloading are complete the user initiates a close operation. The software first aligns the open platter well with the pickup bracket 104, and the pin member 130 then rotates counterclockwise to close the loading drawer 138.

When it is desired to play a different disk, the pin member 130 is rotated counterclockwise from region D through region C to region B. While in region C the rotational arm assembly pegs 310 and 312 interact with the groove region 118 of the locking index 5 to rotate the locking index 114 clockwise. The screw action of the guide groove 116 lowers the guide peg 108 and hence the distal end of the pickup bracket 104. During this downward motion of the pickup bracket 104 the playing disk is lowered into an empty platter well below the disk. With the pin member 130 in region B, 10 the pickup bracket 104 is below the platter 142, allowing clearance for the platter to rotate. The platter then rotates to align another disk position of the user's choice with the pickup bracket. When the new disk position is aligned with the pickup bracket, the rotational pin arm 128 rotates the pin member 130 15 from region B to region C, causing the pickup bracket to lift the disk from the platter 142. The pin member 130 continues to rotate clockwise until it stops in region D. At this point, the pickup bracket 104 is substantially horizontal with the new disk above the platter in the "play" position. While the pin member 130 is in 20 regions B, C and D along wall 302 of the guide slot 202, the loading drawer 138 is both closed and locked.

If the user desires to stop playing a disk, the pin member 130 rotates counterclockwise from region D through region C to rest in region B. If no further operations are initiated, the loading 25 drawer 138 remains in a closed and locked position, and no disk is currently playing.

To load or change disks while no disk is currently playing, the pin member 130 rotates counterclockwise from region B or C (depending upon its location at the time of the "open" operation is 30 initiated), into region A (308), and finally to region F along the wall 306. The aforementioned action of the pin member 130 causes the loading drawer 138 to open and lock in the open position. The user can then change disks or load additional disks by accessing any of the five positions. After changing or adding 35 disks a loading drawer closing operation can be carried out

(initiated by the user) by a clockwise rotation of the pin member 130 from region F to region A, and finally to region B.

A novel CD carousel mechanism has been described above with unique loading drawer movement and loading drawer locking characteristics. Various acceptable software control details to implement a CD player which includes the present invention, are easily constructed by those skilled in the art.

The present invention is not limited to use with CDs of the audio and/or video variety, and is capable of adaptation to information disks in general. Also, the present invention is not limited to use with CD players, but is also operational with general disk readers employing multiple disk carousels.

CLAIMS:

1. A disk loading and unloading apparatus for loading and unloading informational disks into a multiple disk player, said apparatus comprising:

a loading drawer adapted to be opened for loading disks by a user, and adapted to be closed in preparation for said disk player to play loaded disks;

10 a motorized rotational arm member; and  
a pin member coupled to said rotational arm member;

said loading drawer having a pin member guide slot adapted to slidably receive said pin member, said pin member guide slot having a contour defining an interplay between said pin member and boundaries of said guide slot causing said loading drawer to 15 be opened and closed when said rotational arm member is rotated.

2. The apparatus in claim 1, further comprising a locking means for locking said loading drawer in place in at least one predetermined drawer position.

20 3. The apparatus in claim 2 wherein said locking means comprises said pin member, said pin member guide slot, and the interplay therebetween.

25 4. The apparatus in claim 2 wherein said locking means is adapted to lock said loading drawer in a predetermined open loading drawer position, and in a predetermined closed drawer position.

30 5. The apparatus in claim 1 or 3 wherein said pin member guide slot comprises:

a curved middle region; and  
at least an end region with a smaller projected area than said middle region.

35 6. The apparatus in claim 5 comprising two end regions, one on each side of said middle region.

7. The apparatus in claim 5 wherein said pin member guide slot has a centerline substantially perpendicular to the direction of movement of said loading drawer.

5

8. The apparatus in claim 5 wherein said loading drawer is in a locked position when said pin member is at predetermined locations in said middle region.

10

9. The apparatus in claim 1 or 3 further comprising:  
a pivotally mounted pickup bracket for raising and lowering  
a disk mounted thereon; and

a rotatable locking index coupled to the distal end of said  
pickup bracket, and operatively coupled to said rotational arm  
15 member, wherein rotation of said locking index in a first direction  
causes the distal end of said pickup bracket to be raised, and  
rotation of said locking index in a second direction causes the  
distal end of said pickup bracket to be lowered.

20

10. The apparatus in claim 9 wherein said locking index  
comprises a guide groove attached to its periphery, and the distal  
end of said pickup bracket comprises a guide pin adapted to be  
inserted into said guide groove, wherein the interplay between  
said guide groove and said guide pin raises and lowers the distal  
25 end of said pickup bracket with the rotation of said locking index.

11. The apparatus in claim 10 further comprising at least  
one locking index rotation limiter for limiting the amount of  
rotation of said locking index in at least one direction.

30

12. The apparatus in claim 11 wherein said rotation  
limiter limits the amount of rotation of said locking index in both  
directions.

13. A disc loading and unloading apparatus substantially as herein described with reference to the accompanying drawings.



The  
Patent  
Office

1D

Application No: GB 9624214.4  
Claims searched: 1-13

Examiner: Melanie Jennings  
Date of search: 13 February 1997

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G5R (RB73, RPB1, RPB2, RPC1, RPC2, RPC4, RPC6)

Int Cl (Ed.6): G11B 17/022, 17/028, 17/04, 17/08

Other: Online: WPI, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0478198 A1 (MATSHUSHITA), see fig. 3	1

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|---|--|
| X Document indicating lack of novelty or inventive step   | A Document indicating technological background and/or state of the art.  |
| Y Document indicating lack of inventive step if combined with one or more other documents of same category. | P Document published on or after the declared priority date but before the filing date of this invention.          |
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